A Classification of Constructivist Instructional Design Models based on Learning and Teaching Approaches

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Abstract

In a conceptual-analytical study using a deductive classificatory content analysis method ten constructivist instructional design models were selected, and learning/teaching approaches within each model were appraised. Using the original writings of the originators of each design model, the learning and teaching approaches employed or permitted to be used it each model were classified as: (1) individual; (2) group; and (3) dual-purpose approaches. A six-category classification of constructive instructional design models was achieved. Findings show that none of the models has both dual-purpose teaching/learning approaches, and in teaching and learning approaches, most of the models fall in the "individual" category, and only few models fall in the "group" category with regard to teaching and learning approaches.

Key terms: instructional design models, constructivist models, learning approaches, teaching approaches

Introduction:

Most of the previous work on classification and comparison of constructivist instructional design models have used the psychological aspects of learning approaches (e.g. Boetcher, 1998; Dabbagh, 2006). Classifying Instructional design models based on their internal characteristics, which is the subject of present study, has seldom been investigated.

"The discipline of instructional design (which is often called instructional science) is concerned with producing knowledge about optimal 'blueprints' – knowledge about what methods of instruction will optimize different kinds of desired outcomes." (Reigeluth, 1983; 12). In other words, instructional design is conducted when a set of activities and procedures are organized prior to instruction to achieve a set of knowledge, skills, and attitudes; therefore instructional design could be defined as the prescribing and forecasting optimal instructional methods for achieving desired changes in knowledge, skills, and attitudes of designated students.

There are two main theoretical approaches in the field of instructional design; the systematic approach; and the constructivist approach. In the systematic approach, instruction is viewed as a process, consisting inputs, processes, and outputs. In this approach, which is based on behavioral and cognitive psychologies, the outputs or the outcomes of instruction are very precisely predefined and predetermined prior to the instruction. After setting the goals, methods of teaching and learning are foreseen to help the students achieve the desired outcomes.

The constructivist approach is based on epistemological and psychological aspects of constructivist learning, and views instructional design as the preparation of resources and learning processes in order to facilitate students' learning through creation of meaning in their minds (Fardanesh, 1999; 144). There is no emphasis on predetermined design steps in the constructive approach. Rather, the emphasis is on some principles. Such as; include learning in related and authentic contexts; include learning in social experiences; induce having perspective in the learning process; provide the experience of the process of knowledge creation; induce consciousness of the process of knowledge construction; provide experience and appreciate different perspectives; and induce the use of different presentation modes (Fardanesh, 1999; 146).

Various labels based on different criteria are assigned to learning and teaching approaches. For example, some times it is said that the learning approach has a behavioral, cognitive, or constructive orientation. But in the present study teaching and learning approaches are only considered based on being "individual" and/or "group" based. In other words, if the learning and teaching processes mentioned in a

constructivist instructional design model is oriented toward one person or student, the model will be called "individual"; and if it is oriented toward several people or small and/or large group of students, it will be called a "group-based" model; and if the model contains the capacity for designing instruction for both individuals and groups, it will be named a model with "dual" purpose with regard to learning and teaching approaches.

In the remainder of the manuscript, each one of the selected constructivist instructional design models will be scrutinized based on the learning and teaching orientations embedded in their design. In doing so, each one of the models based on their learning and teaching approaches will be classified into three groups; individual, group, and dual-purpose. A six category classification of constructive instructional design models based on the above categories will be presented that could provide a useful guide for application of those models.

Methodology of content analysis

Population under study:

The population of the study is 25 constructivist instructional design models that were identified as a result of conducting a comprehensive search in resources and data bases[1].

Sample under study:

The sample selection method used is Reputational-Case selection (LeCompte, etal., 1993; 76-77), in which reputational constructivist models are selected based on questioning from several experts in the field of instructional design; and as a result the following ten models were selected:

1. Participatory Design Model
2. Anchored Instruction
3. Cognitive Apprenticeship
4. Generative Learning
5. Computer Supported Intentional Learning Environments (CSILE)
6. Discovery Learning
7. Interpretation Construction (ICON) Design Model
8. Mind Tools
9. Problem-Based Learning (PBL)
10. Project Method

[1] For example see the following site:
http://carbon.cudenver.edu/~mryder/itc_data/idmodels.html

Procedures for Qualitative Content Analysis:

Krippendorff (1969) defines qualitative content analysis as an"…approach of empirical, methodological controlled analysis of texts within their context of communication, following content analytical rules and step by step models, without rash quantification."(P. 2). Qualitative content analysis is an approach for empirical, systematic, and controlled analysis of contents using principles of content analysis and the steps suggested in its' model, without hasty quantifications (Mayring 2000).

There are two strategies for qualitative content analysis amongst which two approaches are central: inductive category development and deductive category application." (Mayring, 2000; 4). The deductive category application approach is employed in the present study. In this approach, the analysis begins using a predetermined deductive classification based on theoretical foundations of the topic that is under study. The steps include determining preliminary definitions of each one of the concepts and constructs, and implementing those definitions to each paragraph of the designated texts. These steps according to Mayring (2000) are illustrated in the following figure:

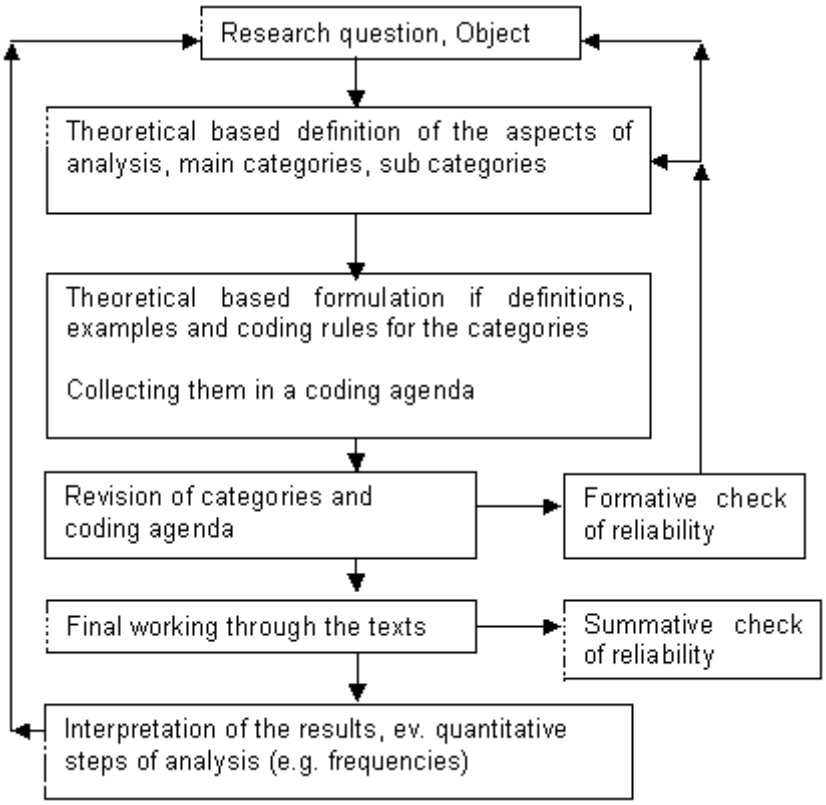

Figure 1: Step model of deductive category application (Mayring 2000)

Definitions applied in the study:

1. Learning Approaches: There are two distinct approaches of learning in the constructivist learning theory; individual, and group-oriented. The

individual approach to learning could be defined as "…the capacity to build knowledge through individual reflection about external stimuli and sources, and through the personal re-elaboration of individual knowledge and experience in the light of interaction with others and with the environment." (Forcheri, etal 2000;P.2). "The requisites for individual learning are perception of a need, identification of an object (an objective) that may satisfy that need, and identification of a strategy for reaching that objective." (Forcheri, etal 2000;P.3). Merrill, etal (1996) declare that: "Groups don't learn, individuals learn. Learners may be part of a group while learning, learners may learn from one another, and the social context of a learning environment may provide support for its members; nevertheless the change in cognitive structure and the acquisition of knowledge and skill is an individual event." (Merrill, etal P. 2).

On the other hand, learning could be considered from the perspective of organizations and communities of people. When a group of people or students become involved in the process of "identifying and correcting their mistakes organizational learning is in process." (Argyris, 1977; p. 117). According to Huber (1991), collective learning need not be conscious or intentional. Further, learning does not always increase the learner's effectiveness, or even potential effectiveness. Moreover, learning need not result in observable changes in behavior. Taking a behavioral perspective, Huber notes: An entity learns if, through its processing of information, the range of its potential behaviors is changed (Van der Linden, etal. 2000). The view of learning as a situated activity emphasizes the actual use of the relevant knowledge or skills within a specific context, and the view of learning as a social activity emphasizes the participation of members of the community. That is, learners must work together to achieve shared learning goals (Adrianus de Kock, etal. 2000; p. 148).

The idea that learning is a social process is based on the work of the developmental psychologists Piaget (who represents the social-constructivist approach) and Vygotsky (who represents the socio-cultural approach). In the social-constructivist approach, learning is an individual process that is influenced by participation in social activities, in the socio-cultural approach, learning occurs in social situations and therefore is a social process (Adrianus de Kock, etal. 2000; p. 148).

2. Teaching approaches: Womack (1989) classifies teaching approaches into two main categories: (1) Expository or Demonstration approaches; and (2) Inquiry or Individualized approaches. He relates expository or demonstration approaches to groups of learners, while recommending the inquiry or individualized approaches for individual learners. Womack presents no logical reasoning as to why expository or demonstration

approaches could not be employed for individual learners, and why inquiry or individualized approaches could not be employed for groups of learners. Whilst Merrill (1983), classifies teaching approaches into two main classes: Expository and Inquisitory categories, and mentions no conditions for individual or group application of the approaches, because both approaches could be used equivocally for both individuals and groups.

Pregnet (2000) classifies teaching methods into three categories:

1. methods based on lectures,
2. methods leaning to dialogue or group work, and
3. methods based on individual learning.

Since according to Pregnet teaching to a group of students is pre-supposed in the methods based on different kinds of lectures. There exists only two classes of teaching methods; (1) methods leaning to dialogue or group work that could be employed for groups of students, including methods based on lectures; and (2) methods based on individual learning that engages students in the learning process as individuals. Therefore teaching methods could also be classified into two categories; individual, and group-based.

In conducting the qualitative content analysis, according to Mayring (2000), the definition of concepts and constructs, and coding for each one of the learning and teaching approaches along with the necessary examples, and their subclasses must be determined. These items are presented in tables 1 & 2.

Based on the definitions, examples, and coding mentioned in Table 1 &2, the selected constructivist instructional design models were analyzed. The results are presented below in order of the models that were evaluated. It must be mentioned that many details exist about each model, but only those aspects of the model that related to the research questions of the present study were evaluated; teaching and learning approaches embedded in the design of the models.

Table 1: classification, definition, examples and coding of learning approaches

Class Name	Definition	Example	Code
Individual	The approach is based solely on Piaget's theory, although social interaction is mentioned, but learning is considered to occur within the individual.	"…we believe it will be necessary to encourage maximum student ownership of the learning process" (Riding, etal., 1995)	1
Group	The approach is based solely on Vygotsky's theory, although individual mental structures are mentioned, but learning is considered to occur socially and within the group.	The class builds its own understanding of many topics and the students carry on discussions about each other's notions. The children's understanding changes through this interaction." (Scardamalia, M. Bereiter, C.. 1991)	3
Dual-purpose	Both Piaget's and Vygotsky's theories are used, and learning is considered to be both individual and group-based.	The students work cooperatively in groups (Collaboration). while the teacher models how to deal with such a site then fades her involvement, while coaching and supporting the students in their own study efforts **(**Cognitive Apprenticeship).The students develop ownership of their work by developing their own interpretations of the history of the site and mustering various kinds of evidence for their conclusions (Interpretation Construction). By arguing with the other students and studying related interpretations in the historical literature, they get a sense of other perspectives (Multiple Interpretations) .By going through the process a number of times bringing each contextual background to bear on a number of different artifacts, the students learn and understand the many ways that the general principles behind what they are doing become manifest (Multiple Manifestations). (Black, J. B., McClintock, R. O. ,1995)	2

Table 2: classification, definition, examples and coding of teaching approaches

Class Name	Definition	Example	Code
Individual	Employing the teaching method for individuals is possible, and no limitations for its' individual application is mentioned.	Curriculum materials should allow exploration by the learner (e.g., interactive sites) to allow active manipulation, questioning, and involvement in the situation . (Bransford, 1990).	1
Group	Employing the teaching method in a group is possible, and no limitations for its' group application is mentioned.	He wanted children to interact with peers, the parents, and society at large, and saw inculcation of self-reliance, initiative, cooperation, and even joy as important concomitants in the learning process. (Lounsbury, J. H., 2005)	3
Dual-purpose	Employing the teaching method for individuals and in groups is possible, and no limitations for its' individual and group application is mentioned.	Wittrock suggests that "To be effective, generative teaching activities induce learners to construct relevant representations that they would not compose spontaneously ". (Wittrock, M. C., 1974, 369)	2

Findings of the study:

1. **Participatory Design Model**: instruction begins in this model with a "Group-based Collaborative Project", in which the teaching orientation is action research, and consequently in this type of instructional activity the possibility of teaching without a group of students dose not exist. But, since in the process of learning each one of the students must produce his/her own "Individually produced learning diaries", the learning approach of the model is "individual" (Riding , etal., 1).

2. **Anchored Instruction:** since the learning approach of this model is "technology-based learning", and each one of the students interacts with the learning environment individually, the learning and teaching approach of this model is "individual". Considering the objective of the model that is to bring about people with problem solving ability through confronting each person with authentic problems in real-world situations, no dual-purpose teaching or learning approaches are foreseen in the model (Bransford, etal. 1).

3. **Cognitive Apprenticeship:** the goal of this model is to make the thinking processes of a learning activity visible to both the students and the teacher through focusing on cognitive and meta-cognitive skills. Thus, the teaching approach of the model in addition to being "individual" could be employed in groups too. Nevertheless, the learning

approach of the model is solely individual, because each student has to learn the way of thinking like an expert by him/her self, and there are no dual-purpose learning approaches embedded in the model (Collins, etal., 1989).

4. **Generative Learning:** the goal of this model is to attain and extract meaning that involves the deeper levels of processing, and depth of processing is thought of as the kind and number of elaborations generated by the learner. The emphasis on deep meaning through encountering with concepts and instructional topics determines the teaching approach of this model as "individual". Nevertheless, the possibility of presenting the topics to groups of students also exists. The learning approach of the model is solely individual, and there is no dual-purpose learning approach envisioned (Wittrock, 1998).

5. **Computer Supported Intentional Learning Environments (CSILE):** the goal of this model is to act as a means for reframing classroom discourse to support knowledge building in ways extensible to out-of-school knowledge-advancing enterprises. Teaching approach in this model because of forming of "knowledge building communities" is group-based. Since learning in this model occurs through classroom discourse, the learning approach is also group-based. Based on the above conditions for teaching and learning there is no possibility for individual learning and teaching in this model (Scardamalia, 1994).

6. **Discovery Learning:** in view of the fact that Bruner describes the goal of education to be intellectual development, and that the science curriculum should foster the development of problem-solving skills through inquiry and discovery, and views the student as an active and motivated individual, the learning approach of the model is "individual". The teaching approach could be both individual and group-based, because instruction begins by presenting a question or a set of questions, and students after discussing the question(s) (that could take place between teacher and student or between teacher and students) determine the problems that are to be addressed. After determining the problem, student(s) decide about the needed data, and the ways of collecting the data. This inquiry could be conducted both individually and in groups (Bruner, 1960; 1966).

7. **Interpretation Construction (ICON) Design Model:** this model by emphasizing on student's encounter with authentic issues in groups; on constructing interpretations by students in groups; searching for information about the problem in groups; and facing different

interpretations about the problem in groups, has a group-based teaching and learning approach. However, in writings about the model, some cues of the acceptance of the individual learning approaches are evident, and therefore dual-purpose learning approaches are accepted in this model (Black, 1995).

8. **Mind Tools:** Kommers, etal (1992) declare the goal of mind tools model to induce and facilitate critical thinking and higher-order learning. This goal is achieved through the application of databases, programming resources, semantic net resources, spreadsheets, expert system resources, multimedia resources, and telecommunications resources. These cognitive tools represent learning with information processing technologies as opposed to learning with them. Therefore, the learning approach is individual, because by controlling the cognitive tools, the learner strives to construct a database about the designated topic. No dual-purpose learning and teaching is considered in this model (Kommers, etal, 1992).

9. **Problem-Based Learning (PBL):** emphasizing group-work on authentic problem, and teaching in groups, this model causes the development of problem solving skills within the groups and individuals. Thus, the learning approach in this model could be dual-purpose. The students' encounter with the problem causes the retrieving of prior knowledge in them, and while the problem resembles very much with what students will face in real job problems in the future, students find the opportunity to elaborate on information that have individually acquired during the process of problem solving (Savery, 1995).

10. **Project Method Model:** this model is one of the oldest constructive instructional models. Learning approach in this model is individual, and its' aim is to bring about researchers and inquirers through participating in research activities. The teaching approach in this model is group-based, because working on problems necessitates group work. No dual-purpose teaching or learning approach is applicable in this model (Kilpatrick, 1918).

The results of evaluation of ten reputational constructivist instructional design models are summarized in Table 3.

Table 3: teaching and learning approaches of ten reputational constructivist instructional design models

Design Models	Teaching Approach			Learning Approach		
	individual	group	Dual-purpose	individual	group	Dual-purpose
Participatory Design Model		X	X	X		
Anchored Instruction	X			X		
Cognitive Apprenticeship	X		X	X		
Generative Learning	X		X	X		
Computer Supported Intentional Learning Environments (CSILE)		X			X	
Discovery Learning	X		X	X		
Interpretation Construction (ICON) Design Model		X			X	X
Mind Tools	X			X		
Problem-Based Learning (PBL)		X		X		X
Project Method		X		X		
Total	5	5	4	8	2	2

Discussion and Conclusion:

As is shown in Table 3, there are very few design models with socio-cultural approach, compared to models with social approach (the group column under learning approach compared to individual column). Considering the design and development requirements of the models with socio-cultural approach, they are more difficult than the other models. The social learning approach models with eight models in the column of individual learning approach are the most popular design models. This point shows that the socio-cultural approach has not penetrated the literature of the instructional design at an optimal level.The dual -purpose column under teaching approach represents the models with high degree of applicability in all kinds of instructional situations. The models under group teaching approach seem to be suitable for all kinds of topics and subject matters. Finally, the models under individual teaching approach are most suitable for instructions with individual learning goals. The

models with dual-purpose learning approach might lead to deep learning objectives, especially the objectives related to social issues.

If the learning approaches are plotted on the vertical axis (individual-group), and the teaching approaches are plotted on the horizontal axis (individual-group), the following Table will be reached:

Table 4: individual, group based learning and teaching approaches

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Learning Approaches</td></tr>
<tr><td>Individual</td><td>Group</td><td>Dual-purpose</td></tr>
<tr><td rowspan="3">Teaching Approaches</td><td>Individual</td><td>Anchored Instruction
Generative Learning
Discovery Learning
Mind tools</td><td>Cognitive Apprenticeship
Problem-based Learning</td><td rowspan="2">Interpretation Construction (ICON) Design Model
Problem-based Learning</td></tr>
<tr><td>Group</td><td>Participatory Design Model</td><td>Computer Supported Intentional Learning Environments (CSILE)
Interpretation Construction (ICON) Design Model</td></tr>
<tr><td>Dual-purpose</td><td colspan="2">Participatory Design Model
Cognitive Apprenticeship</td><td></td></tr>
</table>

There are six classes of constructivist instructional design models in the above table, which based on the designated instructional gorals and circumstances could be applied in different instructional settings. Empirical investigation of the application of each one of the models in suggested conditions proposed in this manuscript need to be undertaken in the future.

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